1.0.4 QUALITY CONTROL AND QUALITY ASSURANCE

1.0.4.1 DEFINITIONS - Quality assurance is composed of two activities: quality control and quality assessment. Quality control is a set of internal tasks performed to provide accurate and precise measured ambient air quality data. The quality control tasks address sample collection, handling, analysis, and reporting. Examples include periodic calibrations, routine service checks, instrument specific monthly quality control maintenance checks, and duplicate analyses on split and spiked samples.

Quality assessment is a set of external tasks to provide certainty that the quality control system is satisfactory. These external tasks are performed outside of normal routine operations. For example, independent performance audits, on-site system audits, interlaboratory comparisons, and periodic evaluations of internal quality control data are such tasks.

1.0.4.2 ATTAINMENT OF QUALITY CONTROL AND QUALITY ASSESSMENT FOR CRITERIA POLLUTANTS - The following tasks contribute to the attainment of quality assurance and provide accurate and precise ambient air quality data.

1. Methods, analyzers, or samplers are federal or State reference or equivalent methods. To assist in the specific selection, ARB maintains an on-going program of instrument and method evaluation.

2. Purchase specifications are written for each type of equipment to ensure that only equipment of the desired quality is obtained.

3. Prior to payment, the ARB performs acceptance tests on new equipment. The acceptance tests consist of testing the equipment to ensure that it meets the requirements listed in the purchase specifications.

   For analyzers, the acceptance test consists of at least checking zero drift, span drift, voltage stability, temperature stability, and linearity. Acceptance test procedures are contained in Volume II for each specific analyzer. Results of these tests are maintained in the central instrument file in Sacramento.

4. Equipment is installed to conform with 40 CFR Part 58, the manufacturer's instruction manual, and guidelines set forth in Volume II, for each specific analyzer.

5. Calibrations are performed in accordance with ARB or U.S. EPA approved calibration procedures.

6. ARB quality control procedures require the use of frequent zero, span, and precision checks. However, caution should be exercised before zero or span adjustments are performed. Often, problems causing analyzer response shifts are due to analyzer malfunctions. Consequently, zero and span adjustment procedures, given in the appropriate appendix in Volume II, are developed to compensate only for normal expected variations in the analyzer response. These procedures are instrument specific; as such, uniform control limits for zero and span adjustments, when applicable, are developed based on instrument stability, gas standards, reliability, and time required to perform the adjustments. Also, the timing of checks should not coincide with times of the day when the pollutant concentrations are at or near peak levels.

7. Analyzers and/or samplers are operated in accordance with the manufacturer's recommended standard operating procedures as presented in the manufacturer's instruction manual and in the specific Volume II appendix. Routine service checks and instrument specific Monthly Quality Control Maintenance Checksheets are used to provide accurate and precise data.

8. Quality control is further enhanced at selected field stations by installing Environics Model 9100, Dasibi Cal II, or Columbia Scientific Industries (CSI) calibrators. The Model 9100 Calibration System consists of three components: (1) the Model 9100 Calibrator; (2) a Pure Air Generator, and (3) bottled gas cylinder blends consisting of high concentrations of NO, CO, SO2, and CH4 in a nitrogen balance. The CSI Calibrator consists of a Model 1795 Calibration Air Supply Chassis and a Model 1790 Programmable Gas Calibration Chassis. The CSI calibrator uses permeation tubes except for zero air and ozone.

   The gas calibration systems conduct through-the-probe (TTP) calibration checks. Calibration checks are performed automatically each day. Special calibration checks may also be remotely initiated through the modem/phone/PC AQDAS system designed especially for the verification of emergency episodes. The daily calibration checks enable analyzer malfunctions to be detected promptly. A detailed description of the CSI calibrator is presented in Volume II, Appendix I. The Dasibi Cal II is presented in Volume II, Appendix G.

9. Quality assessment is accomplished through performance audits and system audits. These audits are an integral part of the ARB Quality Assurance Program. A brief description of various quality assurance tasks follows:

   a. Performance Audits - Performance audits establish individual analyzer accuracy and overall agency accuracy. The audit is performed through-the-probe/manifold to measure the integrity of the monitoring system. Performance audits are performed on at least 25 percent of the analyzers within the ARB reporting organization every 3 months, such that each analyzer is audited a minimum of once a year. Refer to Volume V, Audit Procedures, for details.

   b. System Audits - System audits are on-site inspections and reviews of the entire quality assurance program. It is a qualitative appraisal of the organization, the written procedures, and the records and documentation required to carry on a successful data collection activity. This audit also includes review of the siting requirements and their compliance with 40 CFR Part 58.

   c. Corrective Action - When an analyzer/sampler response differs from true by more than $\pm$10 percent ($\pm$7 percent for PM10 and $\pm$4 percent for PM2.5), maintenance and/or recalibration is required. In general, air quality data are not corrected if the data are within $\pm$15 percent ($\pm$10 percent for PM10 and $\pm$4 percent for PM2.5) of the true value.

      Whenever an audit indicates collected data deviate by more than $\pm$15 percent ($\pm$10 percent for PM10 and $\pm$4 percent for PM2.5) from true, or the converter on a NOX analyzer is operating below 96.0 percent, or if siting criteria or temperature control is not met, the auditor initiates an Air Quality Data Action (AQDA) request. An AQDA request withholds data from ARB's data bank pending investigation and necessary corrective action. Pursuant to an AQDA request, after resolution of any questionable data, the data are either corrected or deleted from the data bank. Detailed data validation procedures are discussed in Section 1.0.6 of this volume.

d. Reaudits - Reaudits are also performed as soon as possible to verify that the deficiencies discovered during a previous audit have been corrected.

e. Collocated Sampling - Collocated sampling consists of two identical samplers running at the same location, monitoring approximately the same air mass (i.e., PM10 samplers). Collocated ambient air monitoring data provide information on the ability of the samplers to generate equivalent data.

f. Parallel Sampling - Parallel sampling consists of either two different types of samplers run by the same agency, or two identical samplers running side-by-side operated by different agencies. Parallel ambient air monitoring data are used to identify sample handling or matrix effects.

g. Laboratory Audits - Laboratory audits of PM10 samples for mass are performed by reweighing 10 percent of samples on a continuous basis. A private contractor recertifies analytical balances yearly. Glass fiber filter strips are received from the U.S. EPA quarterly for lead and semi-annually for nitrate and sulfate as part of the National Performance Audit Program (NPAP) for laboratory analysis. Laboratory performance audits also include conducting standard weight checks using a set of class S standard weights, relative humidity and temperature sensor checks, and a review maintenance logs and quality control records.

h. Quality Control and Quality Assurance Documentation - Monthly Quality Control Maintenance Checksheets and calibration reports are reviewed by appropriate air quality managers or their designees. Acceptance test reports, Monthly Quality Control Maintenance Checksheets, and calibration reports are filed with the Air Quality Surveillance Branch. Single continuous analyzer and single high-volume sampler audit/accuracy report forms are used to document performance audits. These forms and preliminary audit reports are filed in the Quality Assurance Section files. System audit data are recorded on U.S. EPA approved questionnaires and filed in the QAS files.

1.0.4.3 ATTAINMENT OF QUALITY CONTROL AND QUALITY ASSESSMENT FOR TOXICS

1. The ARB maintains an on-going program of sampler and method analyses evaluation, concise written specifications, and acceptance testing to ensure that only equipment of desired quality, which meets the requirements listed in the purchase specification, is obtained.

2. Toxics samplers are installed to conform with the manufacturer's manual and guidelines and cleanliness criteria set forth in the Volume II appendices for the specific samplers.

3. Calibration of toxic samplers regarding flow rates are performed in accordance with ARB approved procedures as contained in Volume II.

4. Samplers are operated in accordance with the manufacturer's recommended standard operating procedures as presented in their instruction manuals and in the specific Volume II appendices. Routine leak checks are performed on samplers and station probes to assure representative data.

5. Quality assessment of toxics data quality is accomplished through performance audits, which are an integral part of the ARB quality assurance program. A brief description of the audits and various quality assurance tasks follows.

   a. Through-the-Probe (TTP) Toxics Audits - Toxics TTP audits are conducted annually at each site by the QAS. A sample (canister) is filled with known (assigned) concentrations of audit gases approximating ambient toxics levels during a 24-hour period. The operator handles and transports the audit sample in the same manner as if it were a routine ambient sample. The analytical laboratory analyzes the sample as a "blind sample" since it is not notified of the audit beforehand. QA then requests the analytical results and calculates the percent difference of the sample for various volatile organic compounds (VOC's), and issues a report.

$$\text{Percent Difference} = \frac{(\text{Measured Conc.}^* - \text{Assigned Conc.})}{\text{Assigned Concentration}} \times 100$$

*Conc. = Concentration

The purpose of a TTP toxics audit is to assess the accuracy of the total measurement system, including errors inherent in contamination due to dirty containers and transport, effects of sample pump and probe, and laboratory error. The detailed toxic audit procedure is contained in Volume V, Appendix J.

b. Toxics Laboratory Performance Audits - The performance of various participating analytical laboratories is monitored semiannually; the list includes ARB's Southern Laboratory Branch (SLB), Northern Laboratory Branch (NLB), Bay Area Air Quality Management District, South Coast Air Quality Management District, and the San Diego County Air Pollution Control District. These laboratories are sent low concentration National Institute of Standards and Technology (NIST) cylinders containing VOC's normally found in ambient air. Their analytical results are compared with the known cylinder (assigned) values and percent difference are calculated as in Volume V, Appendix M. A semiannual report is issued to each laboratory notifying them of the results of the performance audit. This program acts as a quality assurance tool to correct any potential errors that may arise in laboratory procedures or standards. Refer to the detailed laboratory performance audit procedures in Volume V, Appendix M.

c. Ambient Air Comparison-Multiple ambient air samples are simultaneously collected into stainless steel canisters annually by the QA staff at a site historically known for high concentrations of VOCs. These canisters are sent to various analytical laboratories for analysis. The results are statistically compared and used to identify areas that need further improvement.

1.0.4.4 ATTAINMENT OF QUALITY CONTROL AND QUALITY ASSESSMENT FOR METEOROLOGICAL PARAMETERS - The following tasks contribute to the attainment of quality assurance and provide accurate and precise ambient air quality data.

1. The ARB maintains an on-going program of sampler and method analyses evaluation, concise written specification and acceptance testing to ensure that

only equipment of the desired quality, which meets the requirements listed in the purchase specification, is obtained.

2. Meteorological equipment is installed, operated, and maintained in accordance with the manufacturer's manual, and the guidelines set forth in U.S. EPA Prevention of Significant Deterioration (PSD) and Volume IV (Quality Assurance Handbook for Meteorological Parameters) publications, and ARB Volume II.

3. The equipment is calibrated according to the manufacturer's manual and ARB approved procedures in Volume II.

4. Routine field checks are performed to assure representative data.

5. Assessment of meteorological data quality is accomplished through performance audits, which are an integral part of the ARB quality assurance program. Detailed audit procedures are presented in ARB Volume V, Appendix S. A brief description of these audit procedures follows:

    a. Percent Relative Humidity - A triplicate collocated comparison is performed, using a capacitance method humidity sensor. The station sensor and audit sensor measurements are converted to dew point temperature prior to calculating the audit results.

    b. Wind Speed - The sensor's conversion of the sensor shaft's rate of rotation to wind speed is challenged by attaching a variable speed synchronous motor. The starting threshold speed of the sensor is measured using a torque disk, which verifies bearing function.

    c. Wind Direction - Proper sensor orientation is verified using a pocket transit. The sensor accuracy is verified by orientation into the cardinal directions, known landmarks, or by attaching a degree fixture onto the sensor.

    d. Ambient Temperature - When the sensor can be immersed in water, a comparison of temperatures of three water baths is made. A digital thermistor thermometer is also immersed in the water baths. The measurement of the station sensor and the audit sensor are compared.

If the sensor is not water immersible, a triplicate collocated comparison will be performed using the digital thermistor thermometer.

NOTE: Meteorological Equipment Traceability is discussed in Section 1.0.5.1.

1.0.4.5 ATTAINMENT OF QUALITY CONTROL AND QUALITY ASSESSMENT OF NON-METHANE HYDROCARBONS IN AMBIENT AIR

1. The ARB maintains an on-going program of method analyses evaluation, concise written specifications, and acceptance testing to ensure that only equipment of desired quality, which meets the requirements listed in the purchase specification, is obtained.

2. Non-methane hydrocarbon (NMHC) gas chromatographs (GCs) and samplers are installed and operated to conform with the manufacturer's manual and guidelines.

3. GCs and samplers are operated in accordance with the ARB's and manufacturer's recommended standard operating procedures as presented in their instruction manuals.

4. Calibration of NMHC GCs and sampler flow rates are performed in accordance with ARB approved procedures found in Volume II. Routine leak checks are performed on samplers and station probes to assure representative data. Quality control checks, blanks, and duplicates are used to assure the accuracy and precision of the GCs.

5. Quality assessment of NMHC data is accomplished through performance audits which are an integral part of the ARB quality assurance program. A brief description of the audits and various quality assurance tasks follows.

   a. Laboratory Performance Audits - The performance of the participating analytical laboratories is monitored annually. The list includes: ARB's Northern Laboratory Branch, Bay Area Air Quality Management District, San Diego County Air Pollution District, Ventura County Air Pollution Control District, South Coast Air Quality Management District, and various private contractors. The laboratories are sent low

concentration National Institute of Standards and Technology (NIST) cylinders containing NMHCs normally found in ambient air. Their analytical results are compared with the known cylinder (assigned) values and percent biases are calculated as in Volume V, Appendix N. A report is issued to each laboratory notifying them of the performance audit results. This program acts as a quality assurance tool to correct any potential errors that may arise in laboratory procedures or standards. Refer to the detailed laboratory performance audit procedures in Volume V, Appendix N.

b. Through-the-Probe (TTP) Performance Audits - NMHC TTP audits are conducted annually at each site by QA staff. A sample canister is filled with known (assigned) concentrations of audit gases approximating ambient NMHC levels normally collected during a three-hour period. The operator handles and transports the audit sample in the same manner as if it were a routine ambient sample. The analytical laboratory analyzes the sample as a "blind sample", since it is not notified of the audit beforehand. QA then requests the analytical results and calculates the percent bias of the sample for various NMHCs and issues a report.

$$\text{Percent bias} = \frac{(\text{Measured Conc.}^* - \text{Assigned Conc.})}{\text{Assigned Conc.}} \times 100$$

The purpose of a TTP NMHC audit is to assess the accuracy of the total measurement system, including errors inherent by contamination due to dirty containers and transport, effects of sample pump and probe, and laboratory error. The detailed NMHC through-the-probe audit procedure is contained in Volume V, Appendix W.

c. U.S. EPA National Performance Audit Program (NPAP) audits - The NMHC laboratories also receive blind samples prepared by the U.S. EPA as part of a national audit program which measures the accuracy of various hydrocarbon compounds. The audits are conducted during the Photochemical Assessment Monitoring Station (PAMS) season.

*Conc. = Concentration

d. Ambient Air Comparison Checks - Multiple ambient air samples are simultaneously collected into stainless steel canisters annually by the QA staff at a site historically known for high concentrations of NMHCs. These canisters are sent to various analytical laboratories for analysis. The results are statistically compared and used to identify areas that need further improvement.

e. Corrective Action and Reaudits - Whenever an audit indicates that an instrument's response has deviated beyond acceptable limits, the station operator is notified of the problem and that corrective action should be taken. Reaudits are performed to verify that the deficiencies have been corrected.

1.0.4.6 ATTAINMENT OF QUALITY CONTROL AND QUALITY ASSESSMENT FOR LABORATORY ANALYSIS OF NON-METHANE HYDROCARBONS IN MOTOR VEHICLE EXHAUST

1. The ARB maintains an on-going program of method analyses evaluation, concise written specifications, and acceptance testing to ensure that only equipment of desired quality, which meets the requirements listed in the purchase specification, is obtained.

2. NMHC GCs are installed to conform with the manufacturer's manual and guidelines.

3. GCs are operated in accordance with the ARB's and manufacturer's recommended standard operating procedures as presented in their instruction manuals.

4. Calibration of NMHC GCs are performed in accordance with ARB approved procedures. Quality control checks, blanks, and duplicates are used to assure the accuracy and precision of the GCs.

5. Quality assessment of NMHC data is accomplished through performance audits which are an integral part of the ARB quality assurance program. A brief description of the audits and various quality assurance tasks follows.

   a. Non-methane Hydrocarbon Laboratory Performance Audits - The performance of the ARB's Southern Laboratory Branch is monitored

annually. This laboratory is sent high concentration NIST cylinders containing non-methane hydrocarbons normally found in motor vehicle exhaust. Their analytical results are compared with the known cylinder (assigned) values and percent biases are calculated as in Volume V, Appendix X. A report is issued to the laboratory notifying them of the performance audit results. This program acts as a quality assurance tool to correct any potential errors that may arise in laboratory procedures or standards. Refer to the detailed laboratory performance audit procedures in Volume V, Appendix X.

1.0.4.7 QUALITY REPORTS TO MANAGEMENT - In order to apprise management on the performance of quality assurance tasks, the following reports are issued.

1. Criteria Pollutant Including Through-the-Probe Performance Audits Reports
2. System Audit Reports
3. Toxics Laboratory Performance Audit Reports
4. Report of Through-the-Probe Toxic Audit Results
5. PM10 Laboratory Performance Audit Reports
6. Meteorological Audit Reports
7. District PM10 Mass Weighing Audit Reports
8. Acid Deposition Field and Laboratory Audit Reports
9. Annual Hydrological Reports
10. TEOM/BAM Field Performance Audit Reports
11. NMHC Laboratory Performance Audit Results
12. NMHC Through-the-probe Performance Audit Results
13. Motor Vehicle Exhaust Laboratory Performance Audit Results
14. Status Report of Air Quality Data Actions (AQDA's)